

the surface, there may be seen at several points imperfect outlines of what are, presumably, deformed leaf scars instead of mere pseudo-fossils. The trunk, which was perhaps a foot in diameter, may have belonged to *Lepidodendron Veltheimii*, or possibly *L. obovatum*.

Description of the fossils is deferred in the expectation that new efforts will bring to light additional material in the protected brecciated shale fragments. The specimens at present in hand, tho few and very fragmentary, are such as to put beyond question the Carboniferous age of the phyllite at Worcester, thus confirming the opinion of Professors Perry and Emerson. Judging by the details of the few pieces collected, the writer suspects that further discoveries will show the beds to be of Pennsylvanian, possibly Pottsville, age.

BOTANY.—*Annona diversifolia*, a custard-apple of the Aztecs.

W. E. SAFFORD, Bureau of Plant Industry.

While engaged in the study of Annonaceae the writer found a specimen of *Annona*, or custard-apple, in the U. S. National Herbarium, remarkable on account of certain large, orbicular, leaf-like bracts at the base of the flowering branches, from which appear the peduncles, or flower stems, a peculiarity found in no other *Annona* thus far known, except *A. macroprophyllata* Donnell Smith. It proved to be an undescribed species, and a short description of it was published in *Science*,¹ under the name *Annona diversifolia*. The type material included bark, leaves, flowers, and immature fruit, (fig. 1) and the collector's field notes stated that the fruit, locally known as *ilama* or *izlama*, was reported to be edible. No description of the mature fruit was given, however, and it remained to be proved whether or not it could be identified with the celebrated *illamatzapoll*, or "zapote de las viejas," of the ancient Mexicans, the specific identity of which had never been established.

This fruit was first mentioned by Francisco Hernandez, the "protomedico" of Philip II, who was sent in 1570 to study the

¹ New ser., 23: 471. March 24, 1911.

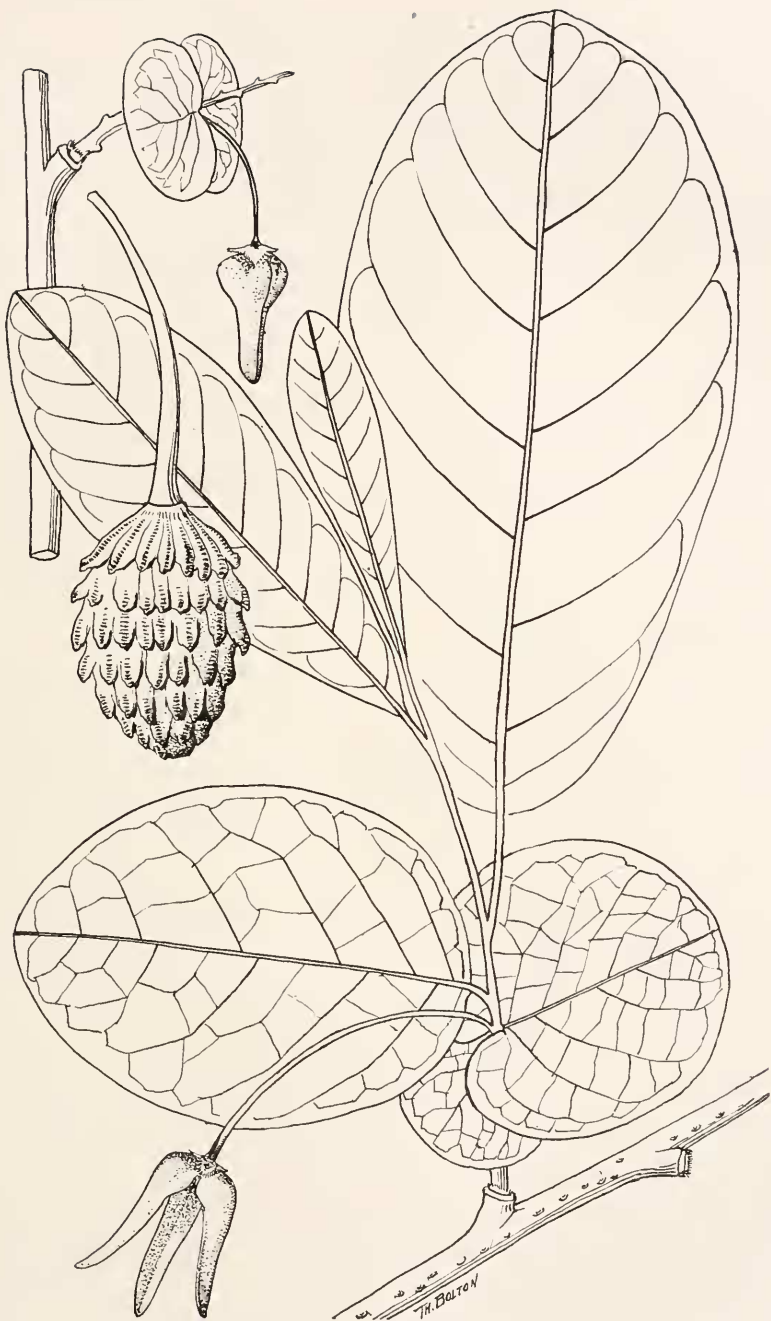


Fig. 1. *Annona diversifolia* Safford, natural size

products of New Spain. A figure of it was published in the first edition of his works, under the name *yllamatzapotli*,² and in a subsequent edition it was said to be identical with the *guanábano* (*Annona muricata* L.),³ tho the original figure does not show the fruit to be muricate like the latter.

Nearly all writers on Mexican fruits have mentioned the ilama, or illamatzapotl, but there is a wide diversity of opinion among them as to its botanical identity. Altamirano and Ramirez thought it to be *Annona excelsa* of Humboldt, Bonpland and Kunth;⁴ Dr. Urbina identified it with *Annona muricata* of Linnaeus,⁵ and Professor Alcocer calls it *Annona reticulata* Linn.⁶ In a monograph on the edible Annonaceae of Mexico, Professor Felix Foex, citing Ramirez as authority, refers the ilama of Colima and Guerrero to *Annona excelsa* H. B. K., without describing its flowers or fruit, and referring to its leaves as "*acuminadas*," a description which applies to *Annona excelsa* but not to the ilama of Colima and Guerrero.⁷

At the request of the writer much valuable information relating to economic Annonaceae has been obtained by Mr. David Fairchild, Agricultural Explorer in charge of Foreign Seed and Plant Introduction, chiefly from our consular representatives in Mexico and Central America, thru the courtesy of the State Department.

In reply to inquiries regarding the fruit known as ilama growing in the vicinity of Acapulco, Mr. Marion Letcher, American con-

² Recchi, Nardo Antonio: *Nova Plantarum, Animalium et Mineralium Mexicanorum Historia a Francisco Hernandez Medico. . . .* compilata. p. 444. Rome. 1651.

³ "Illamatzapotl, quam Haitini Guanabanum vocant"—Francisco Hernandez. *Opera*, 1: 178. Madrid. 1790.

⁴ Altamirano, Fernando and Ramirez, José: "Lista de nombres vulgares y botánicos de árboles y arbustos propios para repoblar los bosques de la República." p. 3. 1894.

⁵ Urbina, Manuel: "Los zapotes de Hernandez." *Anales del Museo Nacional*, 7: 212. 1902.

⁶ Alcocer, Gabriel V.: "Catálogo de los frutos comestibles mexicanos." *Anales del Museo Nacional*, segunda época, 2: 419. 1905.

⁷ Foex, Felix: "Algunas Anonáceas frutales de Mexico." *Estacion Agr. Centr. Bol.*, No. 9: 25. 1908.

sul at that port, forwarded seeds and photographs, which showed it to be an *Annona* somewhat resembling the chirimoya (*Annona cherimola*) and sugar-apple (*Annona squamosa*) but quite distinct



Fig. 2. *Annona diversifolia* Safford, showing fruit leaves and bracts, one-half natural size.

specifically from them both. Photographs, taken by Dr. H. K. Pangborn about two leagues back from the coast, show a tree with dense glossy foliage and pendant conoid fruit which appeared to be covered with whitish felt or cotton (fig. 2). The leaves are

distinctly rounded at the apex, very different in shape from the leaves of the other species mentioned, and the photograph of fruits, fully ripe and bursting open, show them to be shaped "like pine apple cheeses," as Mr. Letcher aptly describes them (fig. 3). The seeds forwarded by Mr. Letcher were totally unlike those of any known species of *Annona*. They resembled, however, some seeds in the economic collection of the U. S. Department of Agriculture of an unidentified *Annona* growing in the republic of El Salvador.

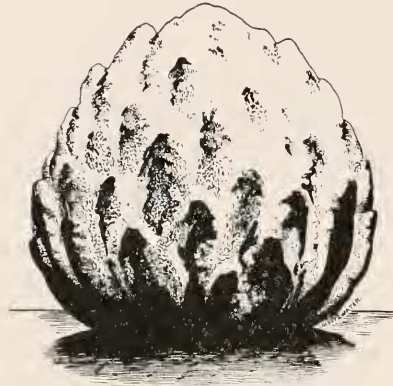


Fig. 3. Mature fruit of Ilama (*Annona diversifolia*) one-third natural size.

with the ilama of Colima (*Annona diversifolia*) and with the ilama of Acapulco. The following is an amended description of the species.

Annona diversifolia Safford. ILAMA, OF ILLAMATZAPOTL Fig. 1. *Annona diversifolia* Safford. *Science*, n. ser., **23**: 471. 1911.

Leaves petioled, blades varying from broadly elliptical, near the base of the flowering branches, to obovate-oblong and oblanceolate, higher up, rounded or obtuse at the apex, and rounded or acute at the base, membranaceous, glabrous, feather-veined, punctulate with minute dots; peduncles solitary 1-flowered, long and slender, recurved or pendent, issuing from one or two sub-orbicular, amplexicaul, glabrous, leaf-like bracts near the base of the flowering branches; flower buds obpyriform; petals linear-

Photographs of the Acapulco fruit were accordingly sent by the writer to the Agricultural Department of Salvador, and a prompt and courteous reply was received from the Director General of Agriculture of that republic, Don Rafael Castillo, who identified it with the species called in Salvador "anona blanca." Señor Castillo also forwarded seeds and leaves of the "anona blanca," which identified it unmistakably

oblong, swollen and concave at the base; fruit conoid or broadly ovoid, covered with dense felt-like pubescence, the individual carpels scale-like when immature, and projecting in thick blunt points directed toward the apex when mature, but sometimes suppressed so that the fruit is ovoid or subglobose in shape; seeds golden-brown or buff colored, obovoid to oblong, with a hard smooth testa devoid of a marginal groove or wing, enveloped in a thin membranous covering when fresh, and surrounded by a richly flavored, cream-colored or rose-tinted, edible pulp.

Type in the U. S. National Herbarium, No. 398834, collected near the city of Colima, western Mexico, July 1897, by Dr. Edward Palmer (No. 60).

Distribution: Colima and Acapulco, western Mexico, to El Salvador; cultivated for its edible fruit. Local names: Ilama, Hilama, Illamatzapotl (Mexico); Anona blanca (Salvador).

Annona diversifolia is a small tree with deep green foliage, and light-colored brownish-gray bark, longitudinally furrowed and set with numerous lenticels. The tender young leaves at first are reddish or copper-colored, somewhat like those of a mango in color, but at length turn green and have a parchment-like texture. They differ essentially from the leaves of the closely allied *Annona macrophyllata* Donn. Smith in size and form and in the length of the petiole. Diversity in shape and size of the leaves is common to many species of Annonaceae, usually the smaller and relatively broader leaves being found near the base of the flowering branches, and larger and relatively narrower leaves following in succession; but in the present species this diversity is most pronounced. The possession of persistent leaf-like clasping bracts at the base of the petioles separates this species together with *A. macrophyllata* from the rest of the Annonas thus far known, and places them in a section apart, which I have called Ilama.⁸ These bracts are glabrous in the present species, while in *A. macrophyllata* the bracts are ciliate on the margin. The smaller and relatively broader leaves at the base of the branches

⁸ See Safford, W. E.: "The Genus *Annona*: the derivation of its name and its taxonomic subdivisions." Journ. Washington Acad. Sci., 1: 118-120. September, 1911.

are 5 to 6 cm. long and 3.8 to 4.8 cm. broad; the largest are 10 to 14 cm. long and 4 to 6 cm. broad, rounded or obtuse at the apex and usually acute or cuneate at the base, with petioles 12 to 16 mm. long. The basal amplexicaul bracts are 25 to 35 mm. in diameter; the floral peduncles, remarkably long for this genus, are 4 to 5 cm. long. The small ovate or triangular calyx divisions are ferrugineous-ciliate on the margins. The fresh petals (20 to 24 mm. long) are described by Dr. Palmer as "light reddish or chocolate colored within and mauve or purple on the outer surface, becoming snuff-colored with age." They differ from those of *Annona cherimola* and its close allies in opening to the base when mature.

The fruit may be described as having the form of an enormous artichoke with an axis of 13 to 15 cm. and a diameter of 12 to 13 cm. On the same tree specimens may be found with the salient points of the carpels quite pronounced while in others they are scarcely apparent. In comparing it with the fruit of the chirimoya (*Annona cherimola*), Mr. Letcher states that the flesh of the ilama is usually pink, sometimes deep rose-colored, the hard nutlike seeds are yellow or yellowish brown (fig. 4 a), and the peel or rind is scurfy and inclined to be

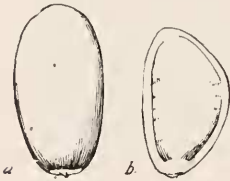


Fig. 4; a, seed of *Annona diversifolia*, b, seed of *Annona cherimola*, natural size.

covered with projecting points. The chirimoya, on the other hand, has white flesh; dark brown seeds with a thin testa easily cut with a knife and surrounded by a marginal ridge (fig. 4 b); and an almost smooth skin usually with a wart-like protuberance near the apex of each outlined areole.

Seeds sent by Mr. Letcher from Acapulco and by Don Rafael Castillo from Salvador are exactly alike; they resemble pine-nuts rather than ordinary *Annona* seeds. They are 20 to 21 mm. long, 12 to 11 mm. broad, and 10 mm. thick, so that they have a broadly elliptical or oval cross-section. The basal hilum is more or less depressed and is devoid of the thickened caruncle which usually surrounds the hilum in other species of *Annona* and in the allied genus *Rollinia*.

Mr. Letcher describes the fruit as "quite delicious" and in a recent communication received through the State Department from Mr. Samuel E. Magill, American consul at Guadalajara, he refers to the "ilama of Colima" as having a richer flavor than the chirimoya, the species which has hitherto been considered the queen of the custard apples.

ETHNOLOGY.—*Definitions of two primitive social states.* O. F. COOK.

Primitive social systems are usually classified by standards borrowed from legal or political science, such as the different systems of inheritance of property or rank. Familiarity with two groups of primitive people, in West Africa and Central America, has suggested the possibility of a different system of sociological classification, based on facts that have a more fundamental relation to the development of civilization.

That a primitive society be matriarchal or patriarchal, or that it be governed by a priestly or a military caste, does not determine its possibilities of progress, for progressive peoples have shown many differences and have survived many changes in these respects. More important factors have been contributed by the external environment, but none of these can be considered indispensable. Capable peoples have developed in apparently unfavorable environments, until they were able to choose their own environments. The underlying question of civilization is to know what conditions are really favorable for the development of human talent.

The essentials of civilization, considered as characters of human races, are not transmitted from one generation to another by prenatal inheritance like the instinctive arts of animals. Human arts and social adjustments have to be acquired by postnatal inheritance, thro the medium of contacts with parents and elders during the years of childhood and youth. It is reasonable, therefore, to believe that any factors or conditions that tend to increase or diminish these contacts are of practical importance in the development of civilization.